NANOSTRUCTURED HOLLOW TUBES BASED ON CHITOSAN AND ALGINATE MULTILAYERS

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The design and production of structures with nanometer-sized polymer films based on layer-by-layer (LbL) are of particular interest for tissue engineering since they allow the precise control of physical and biochemical cues, as well as the recreation of the natural complexity of ECM. In this work, we develop a method for the preparation of nanostructured hollow multilayers tubes combining LbL and template leaching. The biocompatible multilayers films were based on the alternate deposition of chitosan and alginate. Our aim was to produce hollow tubes based on polyelectrolyte multilayer films with tuned physico-chemical properties and study their effects on cell behaviour. The deposition of chitosan (CHIT) and alginate (ALG) for the production of multilayers at 2D level was followed by quartz crystal microbalance with dissipation (QCM-D) and the final tubular structure were characterized by differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR), scanning electronic microscopy (SEM), water uptake and mechanical tests, including dynamic mechanic analysis (DMA) at physiological conditions. It was found that the physico-chemical properties of these tubes can be tailored by chemical crosslinking with genipin which enhances the mechanical properties of the construct and restrain the high water-uptake of polysaccharides –based polyelectrolytes multilayer films. The water uptake decrease from about 300% to 100% after the crosslinking. On the other side, the mechanical properties confirmed the viscoelastic properties and a storage and young modulus about two times higher.
We further evaluate the biological performance in terms of cell adhesion, viability and proliferation. The results obtained with the crosslinked films have demonstrated that these were more suitable structures for cell adhesion and spreading on polymeric films that are otherwise non-cell adhesive. The results suggested the potential of these structures to boost the development of innovative tubular structures for tissue engineering approaches.

Keywords: Layer-by-layer, chitosan, alginate, tubular structures, Tissue engineering